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PATENT ABSTRACTS OF JAPAN

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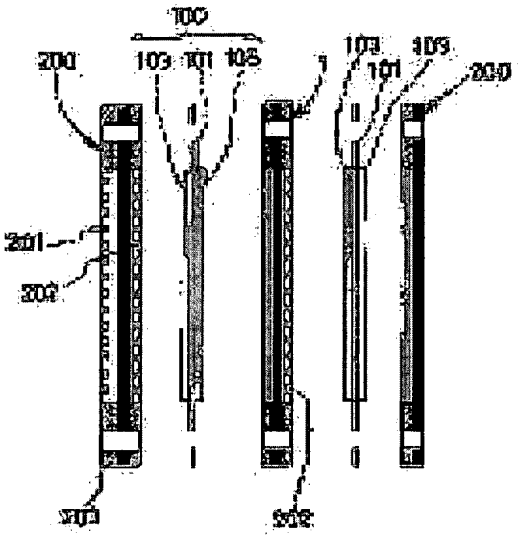
(54) SEPARATOR FOR FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a separator for a fuel cell having high electric conductivity and high corrosion resistance at a low cost.
SOLUTION: This separator 200 is inserted between fuel cells 100 of a fuel cell stack laminated with multiple fuel cells 100 arranged with electrodes on both sides of a solid electrolyte, and it is provided with fuel gas passage grooves 202 for feeding fuel gas to one adjacent fuel cell 100 on one side face and oxidant gas passage grooves 201 for feeding oxidant gas to the other adjacent fuel cell 100 on the other side face. A metal plate 203 used as the base material of the separator 200 is applied with a plating surface treatment with a material selected from a group of silver, chromium nitride, a composite oxide of a platinum group, and a complex of boron carbide and nickel.



LEGAL STATUS

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CLAIMS

[Claim(s)]
[Claim 1] In the fuel cell cell stack to which it comes to carry out two or more laminatings of the fuel cell cell which allotted the electrode to the both sides of a solid electrolyte While being inserted between the aforementioned fuel cell cells, being used, and while adjoining one side and having a fuel gas passage slot for supplying fuel gas to a fuel cell cell It is the separator for fuel cells which equipped the fuel cell cell of another side which adjoins the side of another side with the oxidizer gas-passageway slot for supplying oxidizer gas. Separator for fuel cells characterized by performing plating surface treatment by the material chosen as the metal plate used as the base material of the aforementioned separator from the group of silver, nitriding chromium, the multiple oxide of a platinum group, or the composite of a boron carbide and nickel.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention relates to the separator for fuel cells.
[0002]
[Description of the Prior Art] Various kinds, such as a solid-state macromolecule electrolytic type, a phosphoric-acid type, a melting carbonate type, and a solid-acid ghost type, are known according to the kind of electrolyte with which a fuel cell is used. Among these, it is a fuel cell using functioning as a solid-state polyelectrolyte type fuel cell carrying out the water of the macromolecule resin film which has a

proton exchange group in a molecule to saturation as a proton conductivity electrolyte, and since it operates comparatively in the degree region of low temperature and the generating efficiency is also excellent, various kinds of uses including the object for electric vehicle loading are expected.

[0003] In a solid-state macromolecule type fuel cell, the mixed gas of hydrogen, a carbon dioxide, nitrogen, and a steam is supplied to an anode (fuel electrode) side, and air and a steam are supplied to a cathode (oxidizer electrode) side.

[0004] The temperature of each gas is in the elevated-temperature state of 80-90 degreeC, and high thermal resistance is required by exposing separator to each gas.

[0005] Moreover, in order for separator to connect between each cell electrically, high electrical conductivity and low contact resistance with a component are needed.

[0006] As conventional technology, as shown in JP,8-222237,B, what coated the metal plate with the good compactness carbon graphite of electrical conductivity is indicated. Moreover, preparing the coat of conductive material, such as chromium, a platinum metal or its oxide, and conductive polymer, in a metal plate is indicated by JP,6-349508,A.

[0007]

[Problem(s) to be Solved by the Invention] however, although the former is the technology which carbon graphite coated, and there are the manufacture methods, such as sputtering, in coating of carbon graphite, its productivity is bad and it serves as a high potato's in cost

[0008] moreover, the latter -- chromium and conductive polymer -- corrosion resistance -- an elevated temperature -- the corrosion resistance in highly humid environment is not enough Moreover, although a platinum metal and its oxide of corrosion resistance are quite expensive, the stability in a long time is not enough. In order to make it stabilized, surface treatment is required, and it becomes disadvantageous for productivity and a cost target.

[0009] When using as an object for fuel cells furthermore, it will be exposed to separator as gas before and behind 80 degreeC also containing the potential of about 1 V by electrode reaction, the air supplied, and hydrogen and a steam, and an environmental condition also has a severe thing.

[0010] In addition, cost is high although gold plate is raised as the surface treatment method which was excellent in metal plates, such as SUS, titanium, and aluminum, with electrical conductivity at corrosion resistance.

[0011] this invention is what solved the above-mentioned technical problem, and its electrical conductivity is high, and its corrosion resistance is high, and it offers the low

cost separator for fuel cells.

[0012]

[Means for Solving the Problem] Technical means provided in the claim 1 of this invention in order to solve the above-mentioned technical technical problem (the 1st technical means are called hereafter.) In the fuel cell cell stack to which it comes to carry out two or more laminatings of the fuel cell cell which allotted the electrode to the both sides of a solid electrolyte While being inserted between the aforementioned fuel cell cells, being used, and while adjoining one side and having a fuel gas passage slot for supplying fuel gas to a fuel cell cell It is the separator for fuel cells which equipped the fuel cell cell of another side which adjoins the side of another side with the oxidizer gas-passageway slot for supplying oxidizer gas. It is the separator for fuel cells characterized by performing plating surface treatment by the material chosen as the metal plate used as the base material of the aforementioned separator from the group of silver, nitriding chromium, the multiple oxide of a platinum group, or the composite of a boron carbide and nickel.

[0013] The effect by the 1st technical means of the above is as follows.

[0014] That is, electrical conductivity is high, corrosion resistance is high, and it has an effect of the low cost separator for fuel cells.

[0015]

[Embodiments of the Invention] Hereafter, the example of this invention is explained based on a drawing.

[0016] Drawing 1 is the exploded view of the fuel cell of this invention. Using the cell cell 100 of the structure which pinched the electrolyte layer 101 formed by the solid-state polyelectrolyte by the fuel electrode 103 and the oxidizer electrode 105, using the cell cell 100 of the structure which pinched the cell cell 100 with separator 200, the cell cell 100 is pinched with separator 200, and the laminating is carried out.

[0017] The path 201 through which the oxidizer gas supplied to the oxidizer electrode 105 passes is formed in one side of separator 200. The path 202 through which the fuel gas supplied to a fuel cell 103 passes is formed in other one side of separator 200.

[0018] Separator 200 has the batch function to prevent mixture with oxidizer gas and fuel gas while having a current collection function with electric conductivity to electrodes 103 and 105. As a metal plate 203 used as the base, an aluminum plate, a titanium board, SUS (stainless steel plate), etc. are used. The aluminum which is the material which is especially a low cost is desirable.

[0019] (Example 1) Silver plating processing for producing a silver-plated surface lining to a metal plate 203 is performed. The silver plating to a metal plate 203

performs silver plating processing by 10-micrometer Atsushi by conventional electrolysis plating or a conventional electroless deposition method. Although silver plating is noble metals, surface treatment [that it is cheap and low cost] is possible.

[0020] Table 1 is a graph showing the relation between planar pressure and contact resistance. As a test condition at this time, the test piece by electrolysis plating is used for SUS304 (stainless steel) 45mmx52mm base material, and it is a carbon paper with a thickness of 1.0mm 10cm of touch areas as partner material 2 It was made to contact.

[0021] Consequently, the contact resistance of a test piece like this invention which carried out silver plating processing shows the low value almost of the same grade as the contact resistance of the test piece which carried out gold plate processing to SUS, and satisfies the military requirement as separator of a fuel cell so that this graph may show.

[0022] Moreover, Table 2 is a graph showing the relation of the corrosion test days of a test piece and contact resistance which carried out silver plating processing. Corrosive-environment conditions are performed within the air and steam atmosphere of 75 degreeC. The contact resistance which carried out silver plating processing like this invention is low also on corrosive-environment conditions, and corrosion resistance will become good so that this graph may show. In addition, although the corrosive-environment examination is performed only 50 days in the exam, for the 50th or subsequent ones, contact resistance is the 5m ohmxcm 2. It is thought that it is order.

[0023] (Example 2) On a metal plate 203, nitriding chrome plating (CrN) processing is performed and a nitriding chrome plating surface lining is produced. Nitriding chrome plating to a metal plate 203 is performed by 5-micrometer Atsushi by sputtering and the PDV method.

[0024] A surface of metal is directly coated with nitriding chromium in this example by PVD. This nitriding chromium has realized the separator which was excellent in chemical stability and was excellent also in electrical conductivity.

[0025] Table 3 is a graph showing the relation of the planar pressure and contact resistance about the test piece by which nitride coating was carried out. The test conditions at this time are the same conditions as an example 1.

[0026] The contact resistance of a test piece like this invention which carried out nitriding chrome plating processing shows the value near the contact resistance of the test piece which carried out gold plate processing to SUS, and satisfies the military requirement as separator of a fuel cell so that this graph may show. Besides

nitriding chrome plating, you may use a titanium nitride. Moreover, in the case of a titanium nitride, it is also possible to perform direct nitriding treatment to a titanium board.

[0027] In addition, as an example of comparison, contact resistance does not satisfy the military requirement as separator of a fuel cell greatly so that a graph may show plating processing of nitriding zinc.

[0028] (Example 3) Compound plating processing of the platinum group for producing the compound plating surface lining of a platinum group on a metal plate 203 is performed. Compound plating of the platinum group to a metal plate 203 is performed by 5-micrometer Atsushi.

[0029] Table 4 is a graph showing the relation of the planar pressure and contact resistance about the multiple-oxide plating test piece of palladium (Pd). The test conditions at this time are the same conditions as an example 1.

[0030] The contact resistance of the test piece in which palladium carried out multiple-oxide plating processing like this example 3 shows the low value very of the same grade as the contact resistance of the test piece which carried out gold plate processing to SUS, and satisfies the military requirement as separator of a fuel cell so that this graph may show.

[0031] Moreover, Table 5 is a graph showing the relation of the corrosion test days of a test piece and contact resistance in which palladium carried out multiple-oxide plating processing. Corrosive-environment conditions are performed within the air and steam atmosphere of 75 degreeC. The contact resistance which carried out silver plating processing like this invention is low also on corrosive-environment conditions, and corrosion resistance will become good so that this graph may show. In addition, although the corrosive-environment examination is performed only 35 days in the exam, for the 35th or subsequent ones, contact resistance is the 5m ohmxcm 2. It is thought that it is order.

[0032] Moreover, in addition to multiple-oxide plating of palladium, you may perform nitriding chrome plating and multiple-oxide plating of a ruthenium (Ru) and iridium (Ir). This plating is formed by giving electrolysis compound plating of a ruthenium and iridium and giving anodic oxidation after that.

[0033] Multiple-oxide plating of a ruthenium and a tantalum is also formed by the same method. further -- RuO2 / ZrO2, RuO2 / TiO2, RuO2 / aluminum 2O3, RuO2 / LaO3 etc. -- you may use the multiple oxide of a platinum group

[0034] (Example 4) On a metal plate 203, compound plating processing of a boron carbide and nickel (B4 C/nickel) is performed. Sputtering and PDV perform compound

plating processing of the boron carbide to a metal plate 203 and nickel by 5-micrometer Atsushi.

[0035] Table 6 is a graph showing the relation of the planar pressure and contact resistance about the compound plating test piece of a boron carbide and nickel. The contact resistance of the test piece in which a boron carbide and nickel carried out compound plating processing like this example 4 shows the low value very of the same grade as the contact resistance which carried out gold plate processing to SUS, and satisfies the military requirement as separator of a fuel cell so that this graph may show.

[0036]

[Table 1]

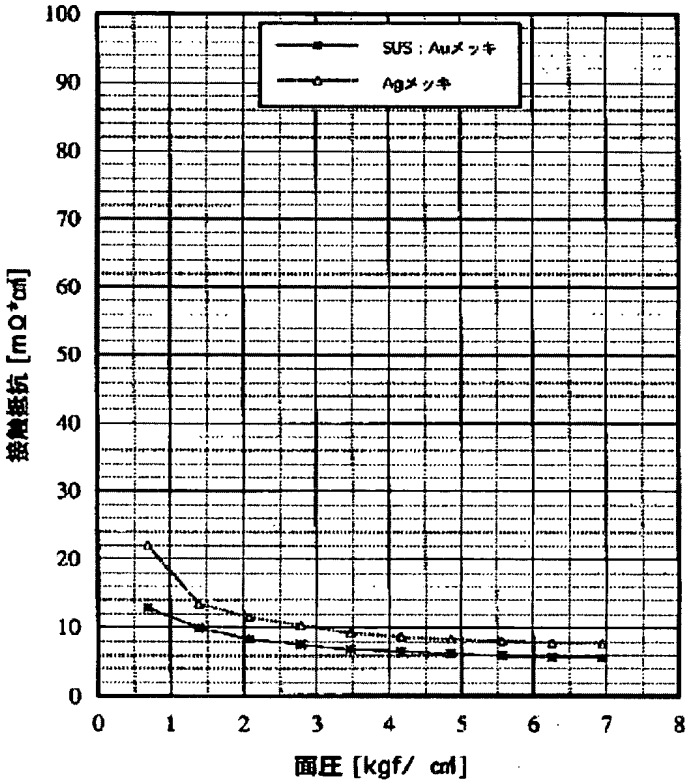

表1　銀(Ag)メッキ試験片の接触抵抗

[0037]

[Table 2]

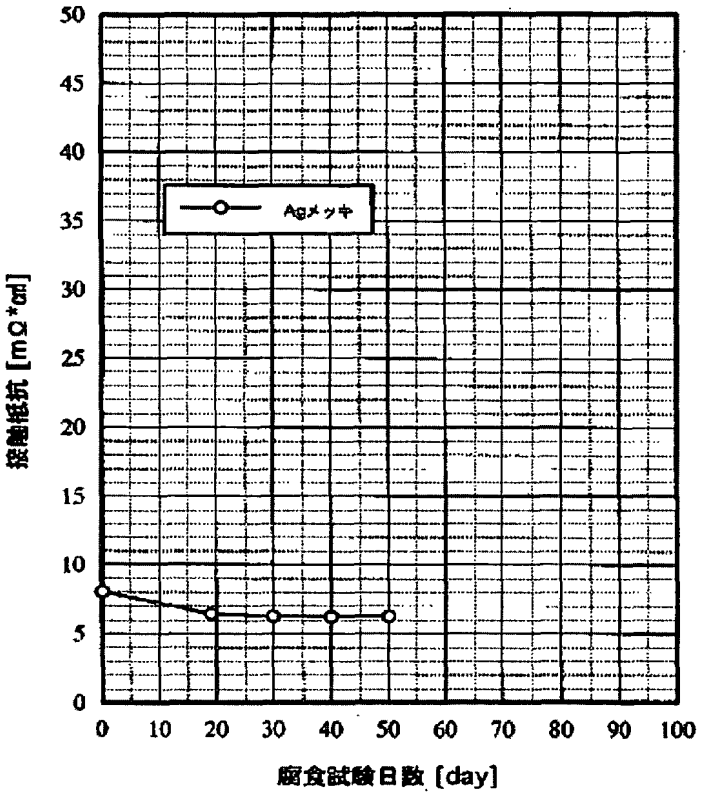

表２　銀(Ag)メッキ試験片の接触抵抗変化

[0038]

[Table 3]

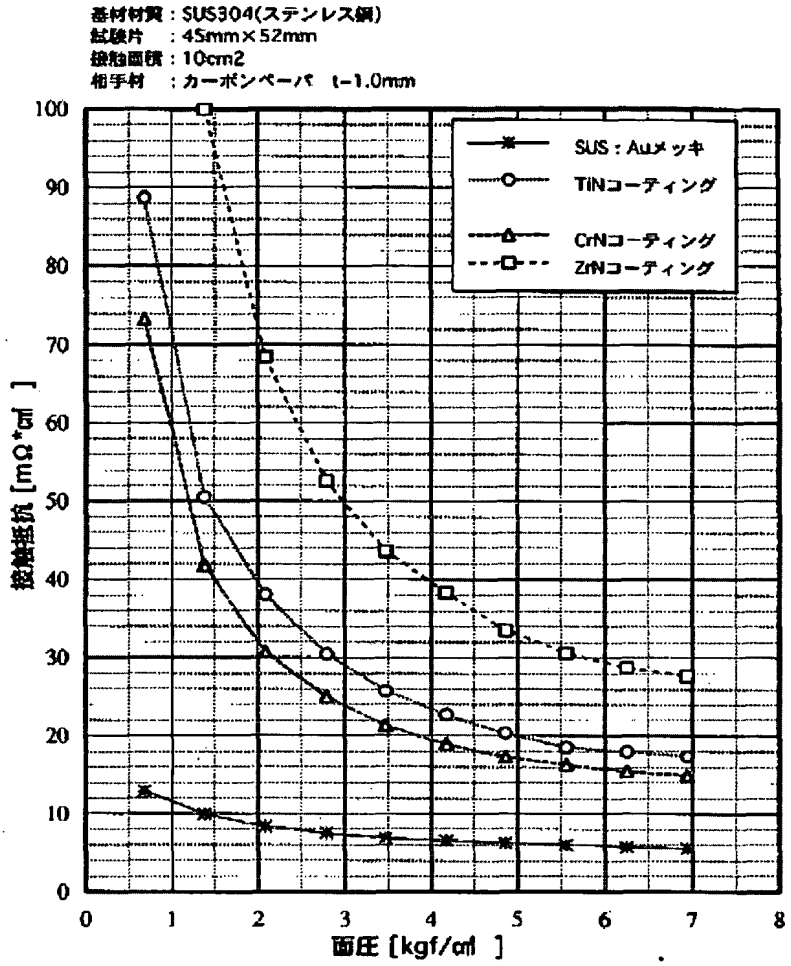

表３　　窒化物コーティング試験片の接触抵抗

[0039]

[Table 4]

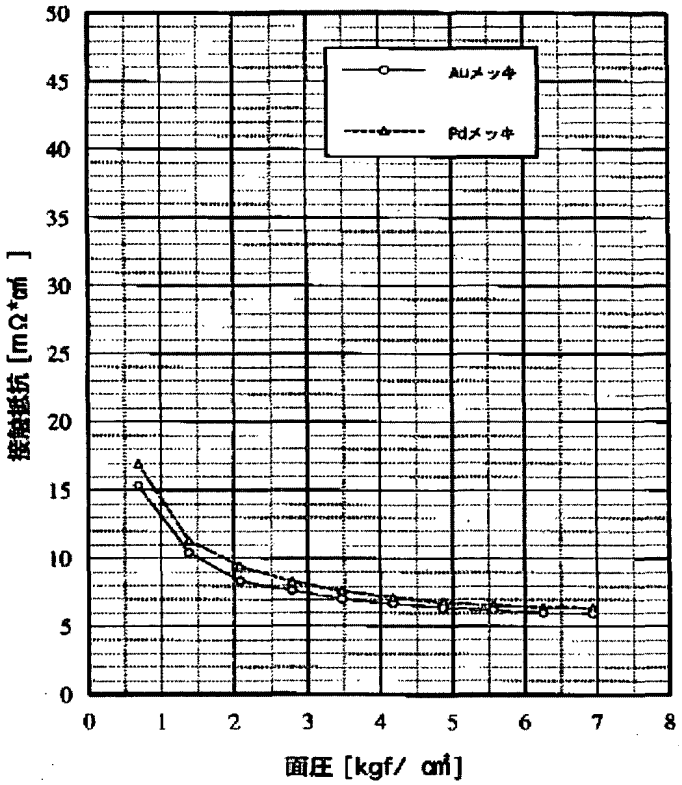

表４　金(Au)メッキ試験片の接触抵抗
パラジウム(Pd)試験片の接触抵抗

[0040]

[Table 5]

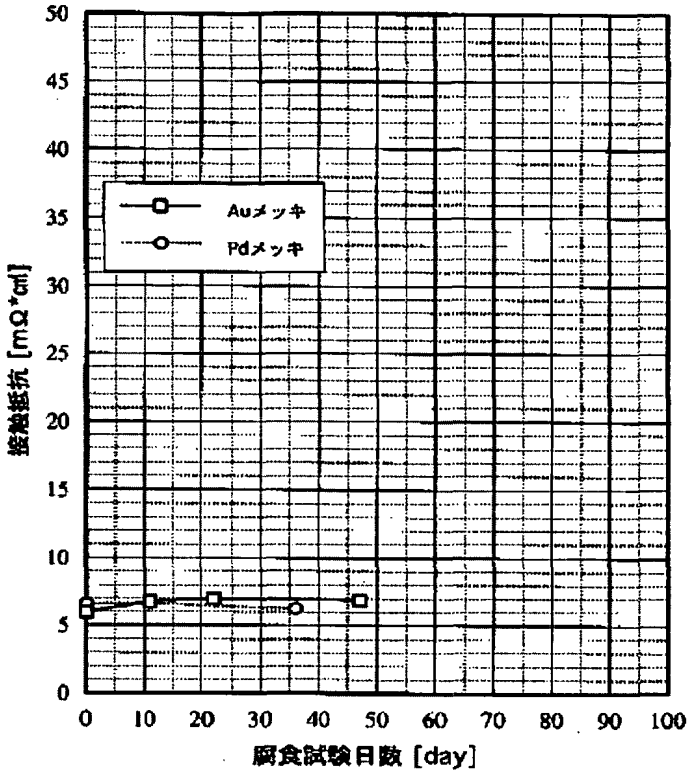

表5　金(Au)メッキ試験片の抵抗変化
　　パラジウム(Pd)メッキ試験片の抵抗変化

[0041]

[Table 6]

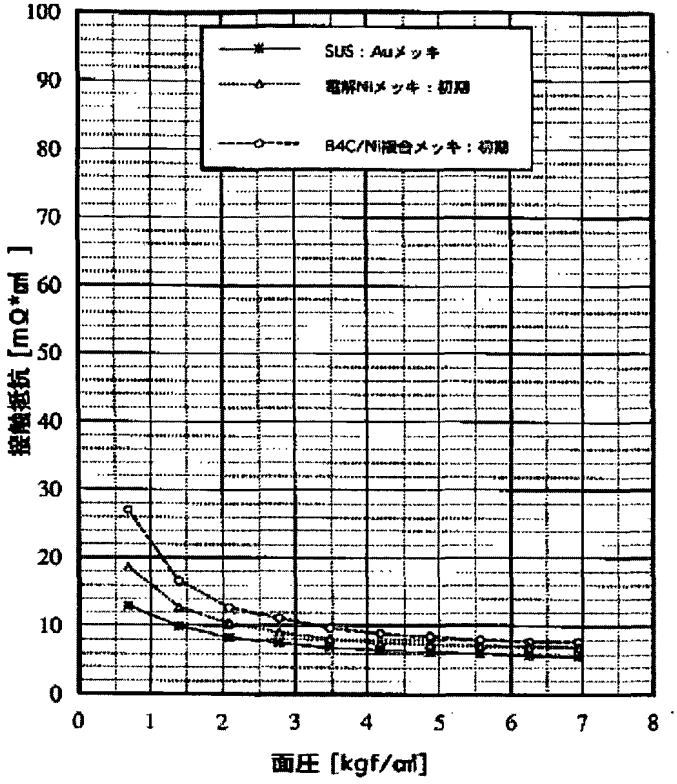

表6　　B4C/Ni複合メッキ試験片の接触抵抗

[0042]

[Table 7]

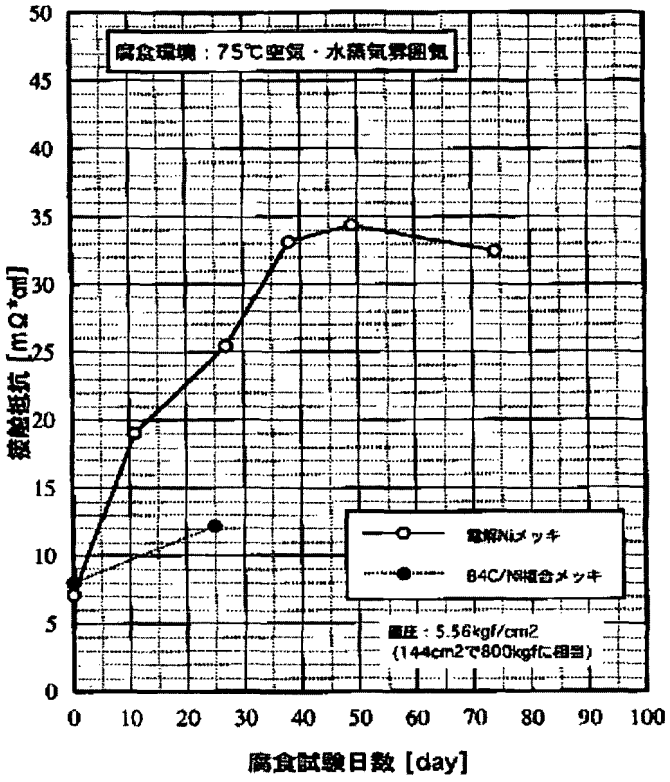

表7　B4C/Ni複合メッキ試験片の接触抵抗変化

[0043]

[Effect of the Invention] Invention of a claim 1 has an effect as the following.

[0044] That is, electrical conductivity is high, corrosion resistance is high, and it has an effect of the low cost separator for fuel cells.

[Translation done.]